pass2: whole data

B field is on, data size: whole pass2 data

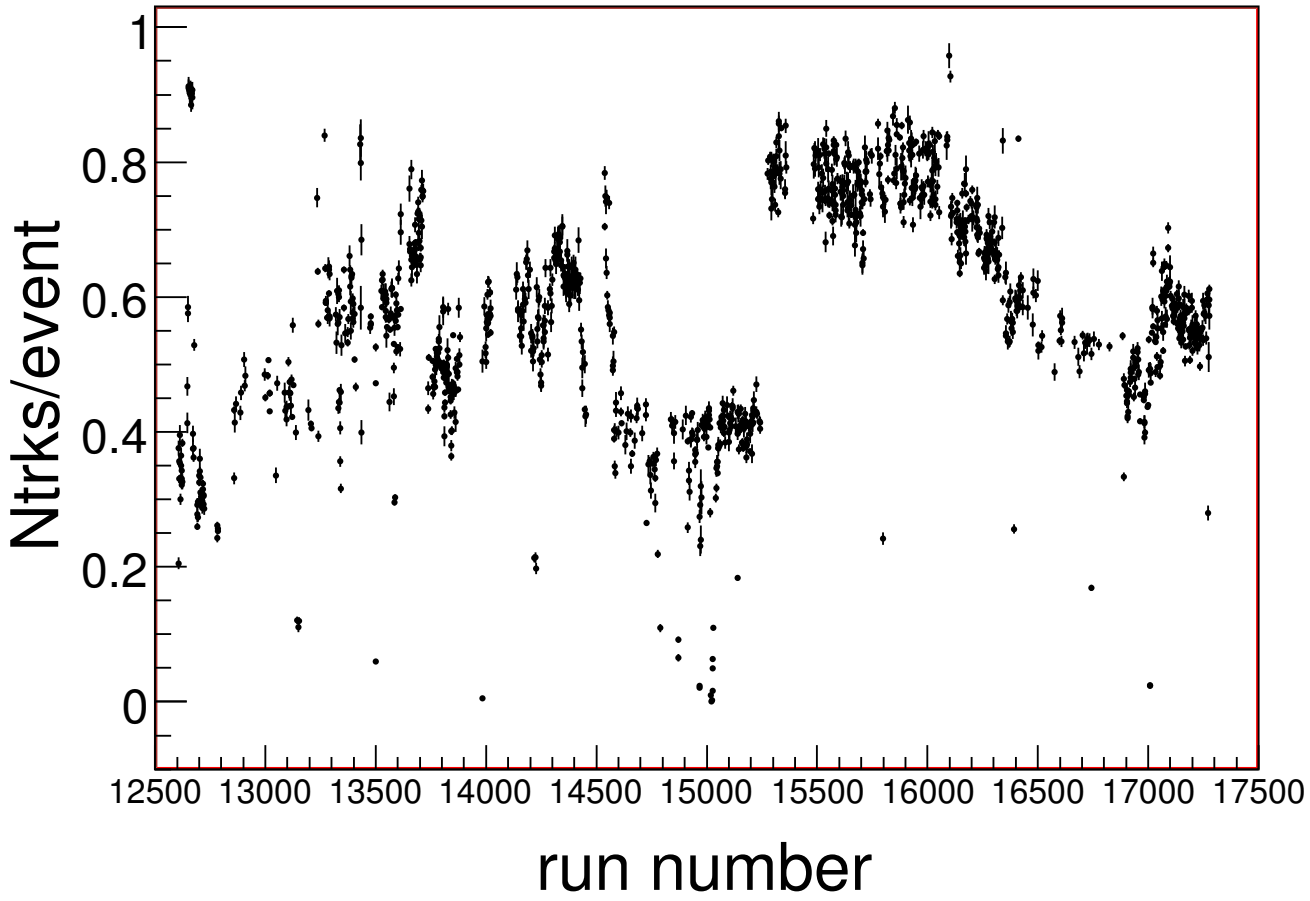
What to study: track - emcal matching

The size of matching window depends on the particle's momentum.

Track selection cuts:

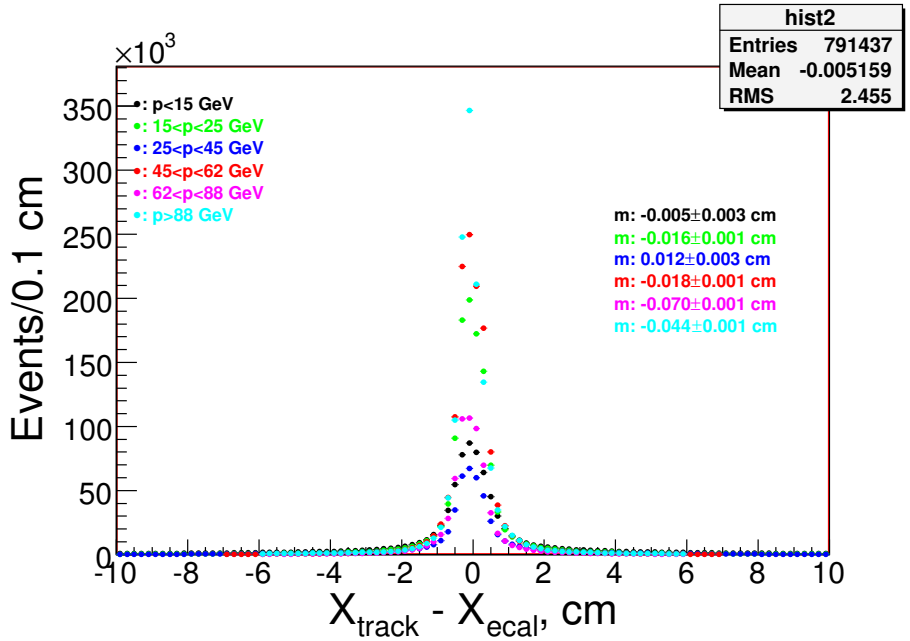
- nTotalTrks $\leq$ 20
- $|X_{vert} - X_{tgt}| < 3$ cm and $|Y_{vert} - Y_{tgt}| < 3$ cm
- $|Z_{vert} - Z_{tgt}| < 20$ cm if NTracks > 1
- 30<NTPCPoints<95
- -10<TrkTime<50 ns
- Tracks with the DC4, PWC5 and PWC6 hits
- The track projections are within EMCAL aperture

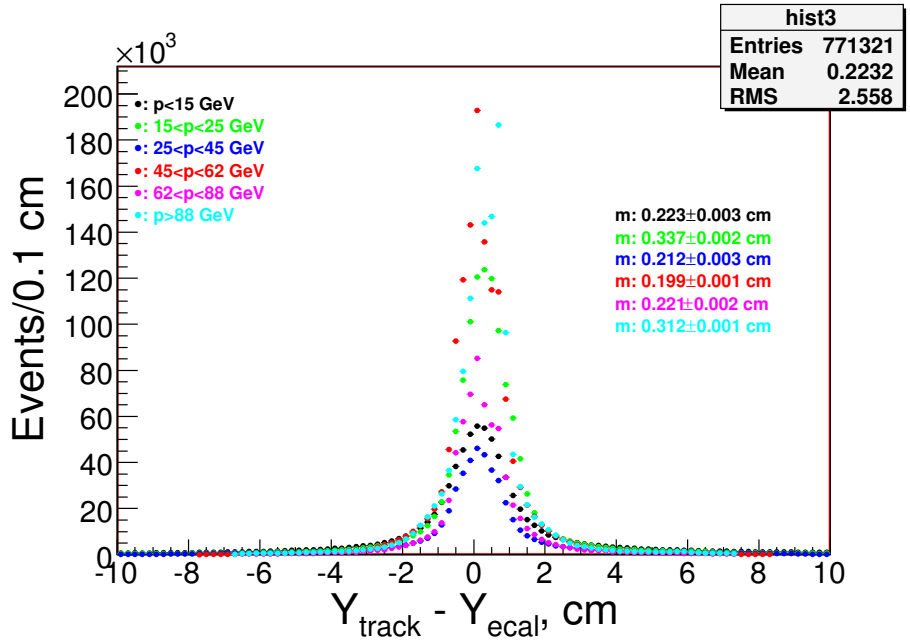
track selection results



The number of tracks passed the selection cuts listed on page 1 normalized to the number of events. Runs 14600 - 15250 are with NuMI target.

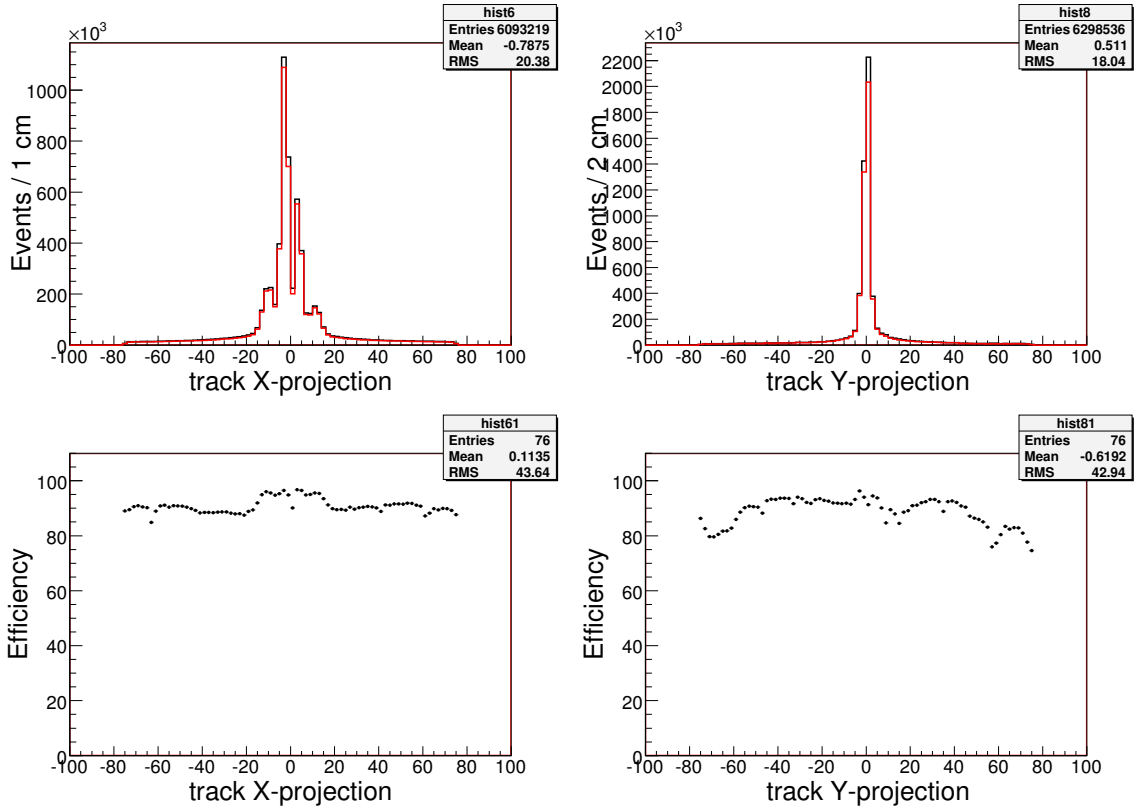
track - shower position differences





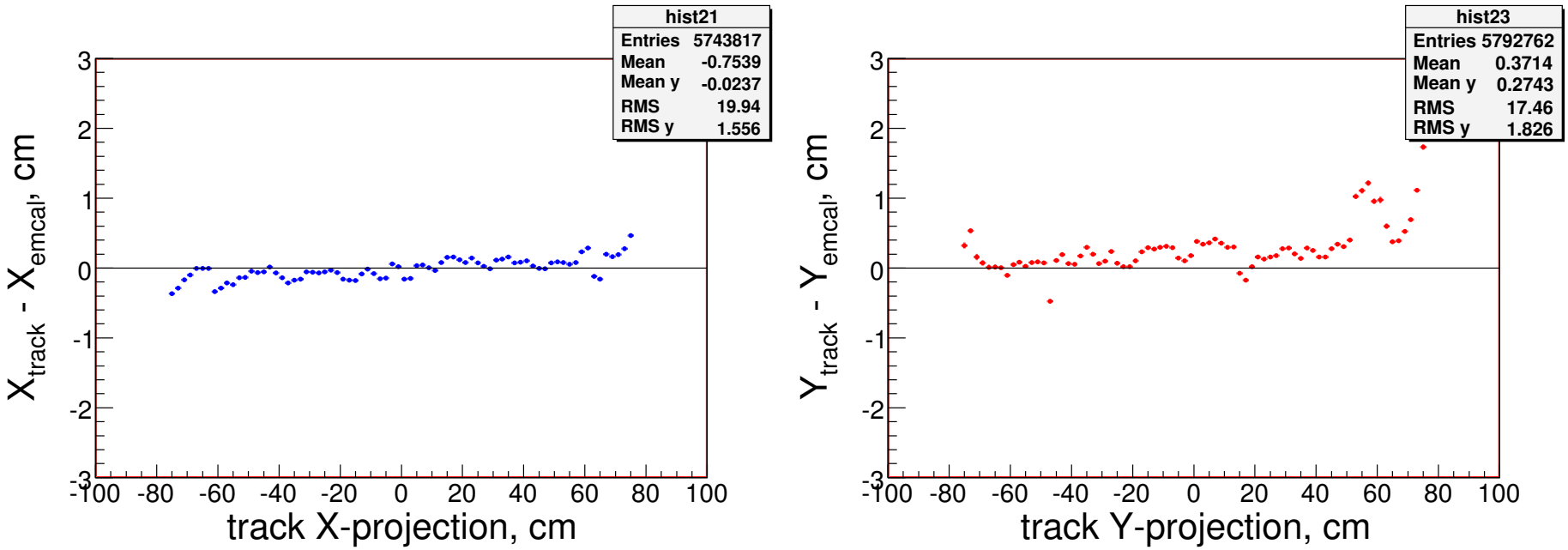
The track - shower residuals distributions for the different momentum. Data in X-view looks at the center, but in Y-view it is off by 2-3 mm. I assume that the offset is due to of the alignment update.

matching vs track position



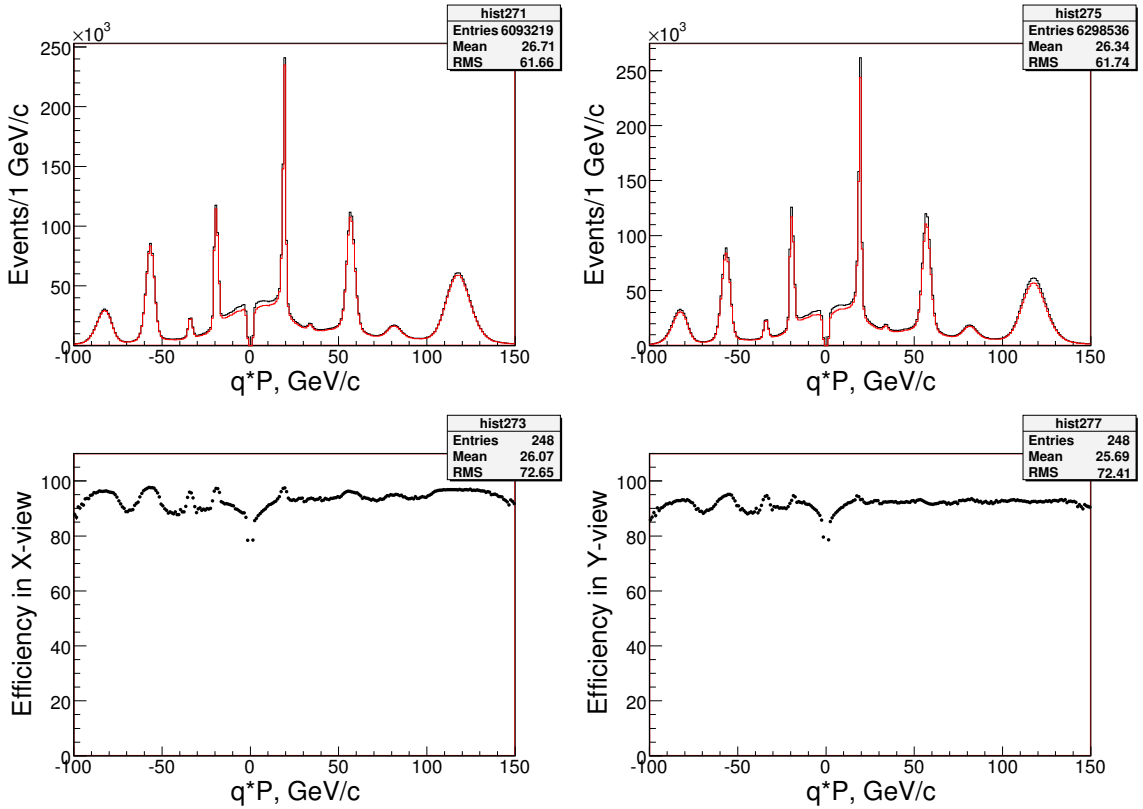
Top black plots - track projections at Z_{emcal}: left - in X, right - in Y views. The red plots - same projections but when the match is on. Bottom plots: the track - emcal matching efficiencies (red / black ratio). The efficiency in X-view looks good. Narrow drop at 0 - dead channel. In Y-view the low efficiency at the right end is due to of the chamber 32 (most top at plane 4). This chamber had wrong electronic reading direction in runs $<$14000. Drop at negative end need to study.

matching vs track position, cont



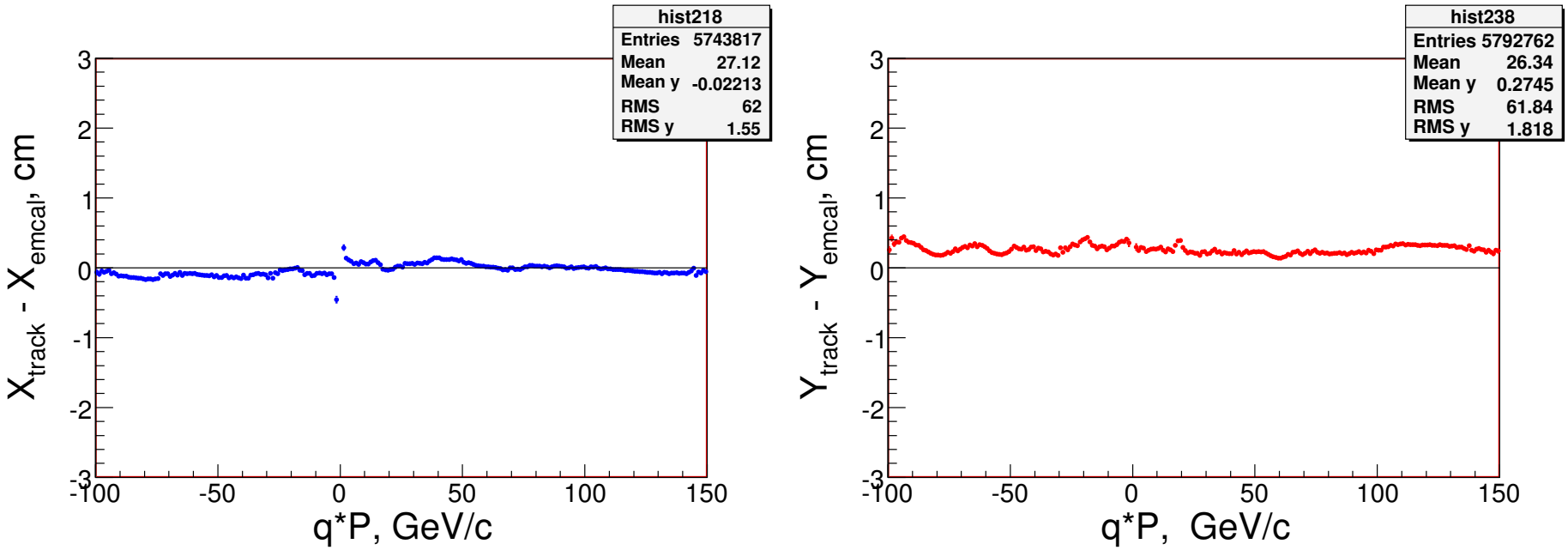
The average dx and dy distributions vs the track projections at Z_{emcal}: left - in X, right - in Y views. Why high offset at the right end in Y-view? Influence of runs$<$14000? Will apply cut on Y-tracks if run$<$14000.

matching vs q·P



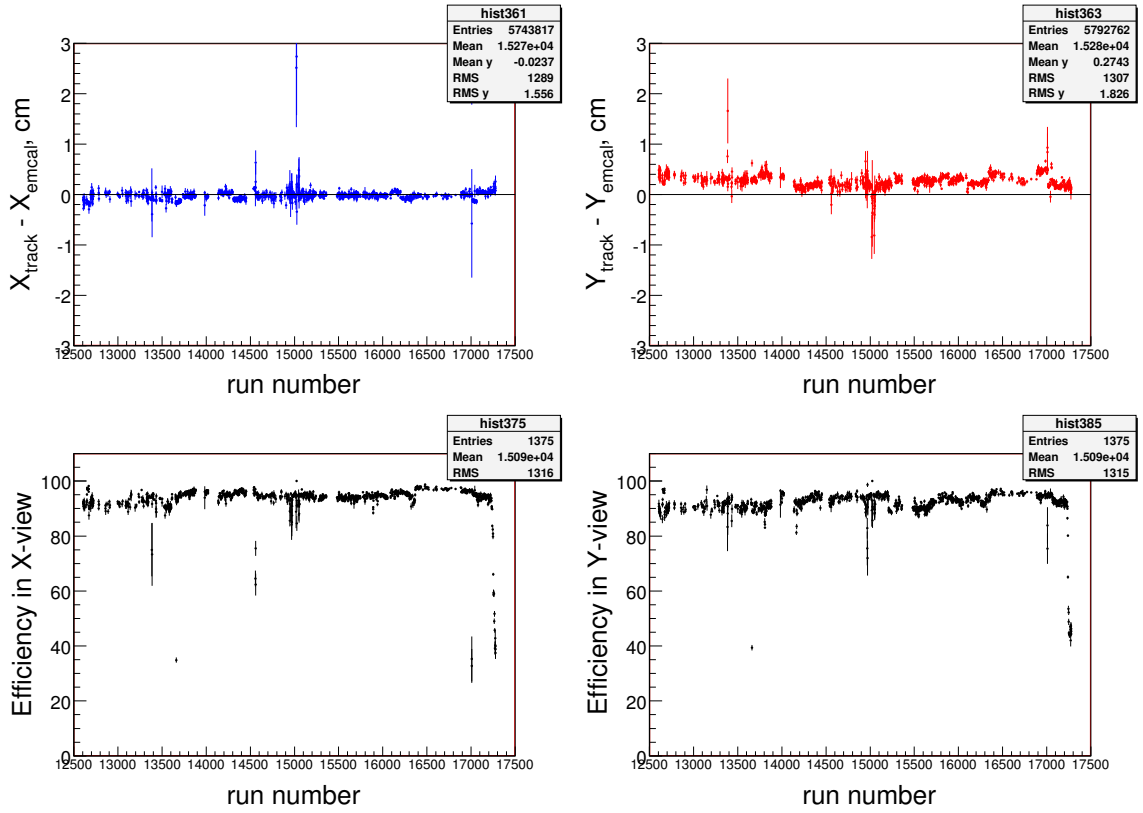
Top black plots - measured q·P values of the tracks. The red plots - same q·P values but when the match is on: left plot - in X, right - in Y view. Bottom plots: the track - emcal matching efficiencies (red / black ratio). The variations on the efficiencies might be due to of the bremsstrahlung radiation associated with the charged particles. Such photon will increase the reconstruction and matching probabilities. Why it is more pronounce on the negative charge side? (more π^o?) Holes at 0 is due to of $\pm$1 GeV/c cut on tracks.

dx and dy vs q·P



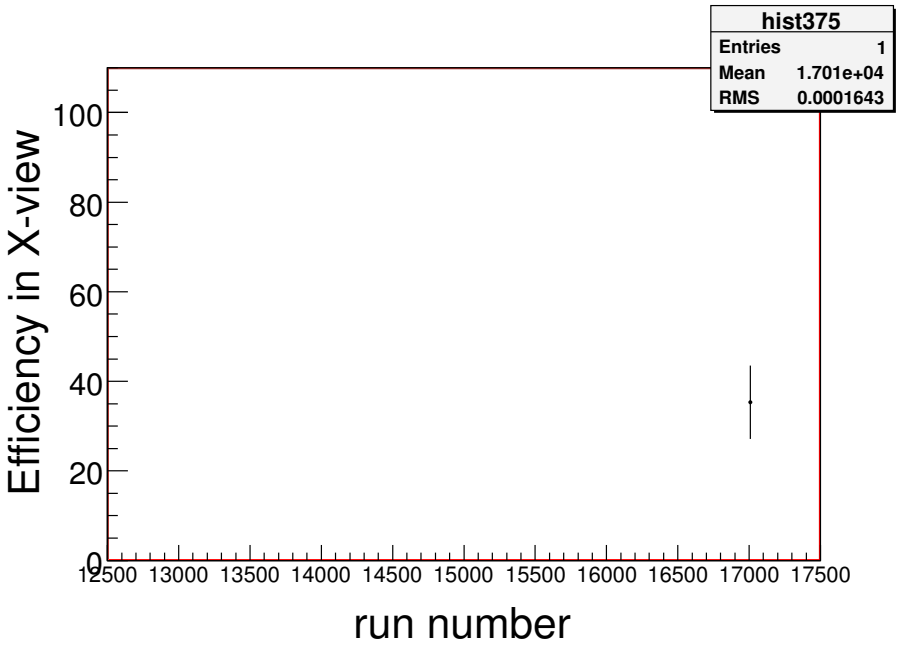
The average dx and dy distributions vs the q·P of the tracks: left - in X, right - in Y views.

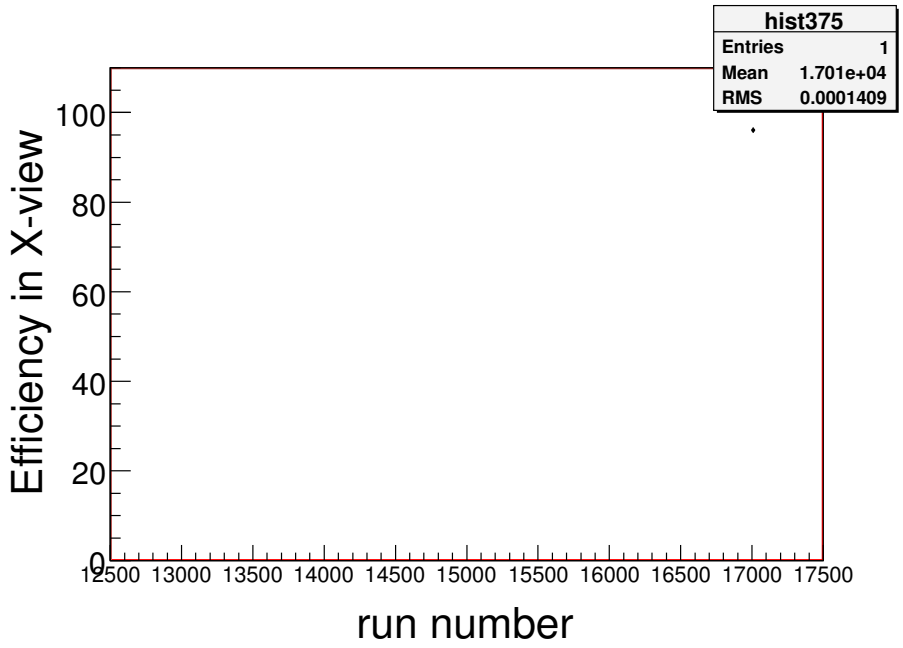
matching vs run number



The top plots: the average dx and dy distributions vs the run number. The bottom plots: the matching efficiency vs the run number, left - in X, right - in Y views. The behavior of the dx and dy variables looks consistent with what was expected. First lowest point in efficiency plot is run 13662: ϵ_x=0.35, ϵ_y=0.39 - EMCal power trip. Runs 17007 and 17008 (X-view) - details on next slide. Runs$>$17269 - B field off runs, they should not be present on this plot. B field off data has low matching efficiency because of the uncertainties in the track extrapolations into EMCAL z position.

matching in run 17007





The track - emcal matching efficiency in run 17007. Left plot: using pass2 data, the matching efficiency is 35 ± 8 %. Right plot: running the same analysis codes after fixing the DB (database), efficiency is 96 ± 0.6 %. In pass2 processing runs 17007 and 17008 were treated as B field off runs. Actually B field was on.

summary

The track projection and emcal shower position are matching to each other within the fraction of mm in X-view and within 2.7 mm in Y-view. Offset in Y-view is due to of the alignment update. We will apply this offset for the next data processing.

Matching efficiency has the position dependence in Y-view: about 10% drop at most top 20 cm of calorimeter. Need more studies.

The combined shower development, reconstruction and the track - emcal average matching probability is 90% in single view and about 80% in both views simultaneously. A few runs with the low efficiency are due to of the mixture of B field off data.